Northeastern Forest Experiment Station

Upper Darby, Pa.

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~~FOREST INFLUENCES~~ WATERSHED MANAGEMENT RESEARCH

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~~FOREST INFLUENCES~~

GENERAL

~~By Herbert C. Storey~~

The report "Effect of 15 years of forest cover improvement upon hydrologic characteristics of White Hollow watershed" prepared by TVA as of June 1951, presents some very interesting data. Analyses of hydrologic measurements during the 15-year period shows that there has been no change in total water yield from the watershed, nor has there been a shift in the seasonal runoff pattern as a result of land use changes. Although there has been a considerable increase in the amount of forest cover, there appears to be no increase in evapo-transpiration water losses. Evidently any increase in transpiration has been balanced by a reduction in evaporation.

Apparently streamflow hydrographs were divided into two elements: groundwater flow and surface runoff. The item "surface runoff" evidently includes all storm flow after groundwater flow has been removed. Storm flow was not broken down into surface runoff and subsurface storm flow. The analyses showed no change in the amount of groundwater runoff nor for the item they designate as "surface runoff". The major change observed was in peak discharges during the summer season. These peak discharges have been very greatly reduced during the period of observation. They further found that the time distribution of "surface runoff" has been materially changed. With the reduction in peak flow a higher flow was maintained for a number of hours after the storm.

The report attributes the change in storm hydrographs to a modification of rainfall intensities by the increased foliage, increased roughness due to litter accumulations, and increased opportunity for temporary surface storage of storm water. Although these factors may

have had some effect, there is considerable doubt as to whether they really explain the change in storm hydrographs. For one thing, a recent study on the Fernow Experimental Forest showed that a hardwood forest canopy had a very small effect upon rainfall intensities. The effect was certainly not of a magnitude that would play a very important part in explaining the reduction in peak flows as shown in the White Hollow watershed study.

There is a very good chance that if storm hydrographs were divided into surface runoff and subsurface storm flow the true reason for the change might become evident. As shown by the study, the greatest change occurred during the first year or two of the study. In this short time infiltration capacities might easily be increased, but percolation capacities through the soil profile would probably be little modified. An increase in infiltration capacity would cause a reduction in surface runoff, but with no increase in percolation capacities there would probably be an increase in subsurface storm flow. Therefore, the reduction in surface runoff would result in a reduction in storm peaks, and an increase in subsurface storm flow would cause a higher sustained flow for a short period following the storm. Thus, total amount of runoff for storms would be unchanged but the time distribution would be considerably altered. Further evidence of this possibility is given by the fact that sheet erosion which was quite prevalent at the beginning of the study became practically non existent towards the end of the period. This could quite easily be explained by a reduction in true surface runoff.

DELAWARE BASIN RESEARCH CENTER

By Nedavia Bethlahmy

Precipitation

Total precipitation on the Dilldown watershed during water year 1953 will again exceed 50 inches. It appears now that the average annual rainfall for Dilldown should be approximately 50 inches.

Although the total rainfall for the year will be equal to or greater than normal, several prolonged periods of drought were experienced during the past summer that had a considerable effect upon soil moisture and groundwater supplies.

An analysis of size of storm for Dilldown has been made and shows that although 45 percent of the total storms that have occurred during the past four years have been only .3 of an inch or less, these storms have produced only 9 percent of the total rainfall.

Soil Moisture

Due to the extended drought periods during the summer, soil moisture levels were extremely low. As a matter of fact, in one portion of the Dilldown watershed even the hardy scrub oak wilted.

We have had fiberglas soil moisture units in the ground since October 1949. We are now beginning to experience some difficulties with these units. Every so often another unit becomes useless. In these units two electrical circuits are involved: a temperature and a moisture circuit. So far we have had trouble (on different units) with both circuits. Any one contemplating the use of this type of soil moisture unit should certainly plan to use duplicate units at each depth.

Interception

It was possible to abandon most of the interception stations in scrub oak cover this year. After 3 years of throughfall measurement, the relationships obtained were following a pattern so similar that no further improvement could be made. Stemflow relationships, although a little more variable, were still satisfactorily consistent. Furthermore, the useful life of a stemflow installation is no more than two or three years. After that time, the stems are affected by the collars and become unhealthy or dieback.

Throughfall measurements are being continued in the high forest area along the creek. This station was enlarged to increase the number of measurements under a rhododendron understory.

This year, interception studies were begun in our coniferous stands at Dilldown. Our main coniferous species is pitch pine, the majority of which is sprout growth. Both throughfall and stemflow is being measured under this sprout pitch pine. Most likely, this is a specialized case—relationships between this type and ordinary coniferous vegetation will no doubt be dissimilar. The sprout growth grows in clumps, with numerous stems from the old stump. Therefore, there are possibly more stems per unit area but a lesser crown cover.

Both stemflow stations at the Pocono Experimental Forest, in high forest cover, were reactivated along with one of the throughfall stations.

Cooperation

Another year's accumulation of soil moisture data as collected on the Dilldown watershed was sent to the Vicksburg Infiltration Project. We hope that these data will contribute to the very worthwhile results the fellows there are coming out with.

MOUNTAIN STATE RESEARCH CENTER

By Staff

Watersheds

Stream runoff, as a percentage of rainfall, from five forested watersheds on the Fernow Experimental Forest, shows the following seasonal pattern based on two years' observations:

	First Year - 1951-1952 Watersheds					Second Year - 1952-1953 Watersheds				
	1	2	3	4	5	1	2	3	4	5
Growing period										
Rainfall (inches)	26	26	26	26	--1/	21	21	21	21	22
Runoff (percent)	26	32	32	30	--1/	14	17	17	15	20
Dormant period										
Rainfall (inches)	34	32	32	32	32	30	29	29	29	29
Runoff (percent)	52	65	57	57	72	46	55	50	51	67

1/ The gaging equipment on this watershed was not in operation during the early part of the first growing season.

There is a much wider range between rainfall and runoff on a monthly basis. The percentage of runoff ranges from less than 1 percent in August to over 95 percent in January and February.

This terrific fluctuation emphasizes one of the water problems in this area--the wide range of available water supply.

It is interesting to note that water losses (obtained by subtracting total runoff from rainfall) are practically the same for the two years, although there is a difference of some 8 or 9 inches in total precipitation. The difference in precipitation shows up entirely in a difference in runoff for the two years. This only goes to bear out the established fact that runoff is a residual that is supplied after satisfying all prior demands on precipitated water.

Skid road erosion

Late spring rains of very high intensity caused more erosion from skid roads than occurred during the previous six months--when rainfall was more gentle.

A study was started in the spring of 1953 to determine if a vegetative cover could be established on skid roads by using chaff from local sources. These tests were made on skid roads that had been bulldozed and were considerably compacted. Use of the chaff was tested with and without fertilizer and lime, and with and without a mechanical disturbance of the soil surface.

Results of this study are as follows: 1. Mechanical disturbance showed no significant difference in the percent of vegetation (groundcover) or height growth; 2. the limed and fertilized plots showed a significantly greater percent of vegetative groundcover and significantly greater height growth of vegetation than the plots which were seeded but not limed and fertilized. The following table shows the results to date:

Treatment	Vegetation density	Height
	Percent ground covered	Inches
Seeded only	26.0	4.9
Seeded, limed, and fertilized	40.0	8.4
No seed or treatment	0.5	0.7

The color and vigor of the vegetation on the limed and fertilized plots looked much better than on the plots which were only seeded.

On all of these plots measurements will be continued for two more years to find out if the present vegetation reseeds and if the beneficial effects of treatment continue.

Sedimentation Study

During the summer of 1952 a logging truck road was built in a forested watershed. Previous to the construction of this road and periodically thereafter paired water samples were taken from this and another undisturbed forested watershed, which serves as a control. Sediment analyses were made on these samples.

Before construction, the amount of suspended sediment in both streams was low at all times and well within standards for domestic consumption. After construction, the amount of sediment in the stream from the watershed with the road increased, particularly after heavy rains. Water sample analysis showed a maximum of 173 ppm. from this stream. At the same time, the control watershed sample analyzed only 8 ppm.

This road has not been used as yet but is "resting" before logging starts in this hollow. After several months, the fine material has largely washed away from the surface of the road and the adjacent disturbed areas. As a result, the level of sediment carried by this stream is gradually approaching that of the control.

The purpose of this study is to evaluate the effect of a certain standard of road construction and use on sedimentation.